THE BLACK HILLS.

RESOLUTIONS OF THE MINERS.

THANKS TO GEN. CROOK AND PROF. JANNEY—THE NEW CITY DUBBED CUSTER BY THE MINERS.

[BY TELEGRAPH TO THE TRIBUNE.]

BLACK HILLS, Aug. 11, via Fort Laramie Aug. 15.—One hundred and fifty miners of the Black Hills organized yesterday at 10 a. m. in a cabin on French Creek, the site of the supposed City of Custer. Mr. Swearingen was elected Chairman. After the reading of Gen. Crook's proclamation, the following resolutions were adopted:

Whereas, The President of the United States did on the 16th of July, 1875, issue a proclamation ordering all miners from the Hills immediately, and being in the Department commanded by Gen. Crook, and it being his duty to remove us from these hills; therefore,

Resolved, That we tender our sincere thanks to him for the kind and gentlemanly manner with which his command have executed his order.

Resolved, That we also tender our sincere thanks to Prof. Janney and his company for their courtesy and the gentlemanly manner with which they have treated the miners of the Black Hills.

Resolved, That, though having been in the Hills but a short time, we are thoroughly convinced that this is one of the richest mining districts in the United States, as far as the country has been prospected, and in obeying the command of the President we do it under protest.

Resolutions were adopted naming the town Custer City, and giving every miner a lot. These titles may not be good, as a man is on his way to Yankton to have a plot of the city filed, calling it Stonewall. Spotted Tail has returned home. He thinks the damage on each creek will not fall short of $50,000. Six miners will stay, taking charge of the property of the rest.

GEN. CROOK AMONG THE MINERS.

PROMISE OF THE MINERS TO LEAVE THE HILLS—EFFORTS TO RETAIN POSSESSION OF CLAIMS—MASS MEETING OF THE MINERS—AN ASCENT OF HARNEY'S PEAK.

[FROM A SPECIAL CORRESPONDENT OF THE TRIBUNE.]

SPRING CREEK, Dakota, Aug. 2.—Gen. Crook's proclamation to the miners, commanding them to leave the Black Hills before Aug. 15 next, has long since doubtless been read by Eastern people. This ends the Black Hills excitement. The General has entered the Hills, surveyed the field, and in a kind, determined way, settles the question of miners roaming among the mountains. Seeing them here, and knowing the wishes of the President, he issued the proclamation, which will have a deep effect in every town of the Far West. It bears the impress of a man entitled to respect for his great common sense, and his commands will be obeyed. The proclamation affects thousands of men who are here, and hundreds who were coming here. The lowest estimate of the number coming was 1,500; the highest, 2,500. When it is considered that the men here are under the discouraging circumstances of a blockade by soldiers and hostile Indians, and the impediments of a newly discovered land, it will be readily seen how small in numbers they are in comparison with the multitude that would have come at a more favorable time. Then each of them had a greater or less circle to influence by his absence in the far West among Indians and unknown dangers. The home folks are eagerly watching for news, whether of fortunes won or calamities safely passed. Now the news will go from one to the other: "They are coming back." This proclamation will live as a memorable subject of conversation among the Western people. And Gen. Crook's name will be spoken with respect and regard long after these placer bars have been worked out.

Gen. Crook started from Fort Laramie escorted by Capt. Mix of the 2d Cavalry and accompanied by several persons who had the privilege of seeing the wonders of this remarkable country. New-York was represented by Messrs. B. H. Campbell, A. L. Foster, and V. Foster; Chicago by Gen. L. Smith and son; Cheyenne by Geo. Wilson. Col. Stanton, paymaster, accompanied the General to make the officers and soldiers richer by two months' salary. Many of them had "panned" and "rocked" for shining nuggets, scorning greenbacks, but time and experience made the Colonel's visit welcome. The crisp notes had a weight that prospective hard money lacks, and payments were not refused therefore when Col. Stanton handed them out. The party arrived at Custer's Gulch on the 27th of July. Here they saw the first miners, and had an opportunity to "pan" some gold. Here was the actual work, here the gold. Said one of the party afterward to me: "Mr. Correspondent, the sight of those miners and the gold shook my faith just a little in your trustworthiness."

"What do you mean?"

"I have read your letters in THE TRIBUNE, you know, and here I saw the actual gold, and I thought you must have made a mistake about the Black Hills being rich."

"But I have never said there was no gold here. My position has been that so far no rich diggings had been found; that there are not yet known to be the gulches of old California, and that poor men can do better at home."

It is well to call especial attention to an error that is so common. To any but those experienced in mining the distinction between "no gold," poor, fair, and rich diggings is not made. Seemingly the popular idea is that the merest showing of a "prospect" means necessarily fortunes to the lucky ones who find it. In no business is there so little attention paid to facts as in mining. Persons who have been in mines are seized with a madness, a kind of fever, at the sight of the yellow shining particles of gold, and a certainty takes possession of them that "it is there." The gentleman I have spoken of, on seeing the miners at work at once thought THE TRIBUNE's correspondent was wrong, for, "hadn't he said there were not rich diggings, and here was the gold which any one could see." The difference between the presence of gold and rich paying placer mines is wide.

GEN. CROOK AND THE MINERS.

Gen. Crook and his party passed on up the gulch, crossing the divide, and came down to the head of Spring Creek on July 27. Thence continuing their march, they arrived at this camp on July 28. On the march the General sought opportunities to converse with the miners. Knowing from his long experience in California how to detect a "tender foot" (a greenhorn) from an "old timer," his few questions brought out all the facts about gold, the number of miners in the Hills, and what the feeling was among them about leaving the Hills. The camp is on Spring Creek, at which, as stated in a previous letter, there are two companies of infantry escorting Mr. Janney, who is still here continuing the "prospecting" of this gulch. Here the General's column halted for the night, but he pushed on, wanting to see Col. Dodge who was on Rapid Creek, the next stream north. Gen. Crook only stopped here long enough to shake hands, and to discuss the species of a partridge which I had shot. Being an enthusiastic ornithologist, as most hunters are, the sight of this bird made him halt like a setter on a point. The bird is a partridge, but I believe a new species. Gen. Crook had never seen it before, nor had I, and Coues's book was diligently searched from that terrible key to the last chapter of Marsh's on extinct birds, but with no results. Sportsmen as well as ornithologists will want a description, but, the pressing theme being the miners, they must be content with hearing from Profs. Baird or Marsh, to both of whom I shall send skins of the partridge for classification. The continued reports of rich "finds" and new "bars" which require a correspondent's attention has left me no time to collect birds. I believe there is a new kind of woodpecker here, which I will obtain if the next mail suffers. It may seem strange that there has been "no time" to get specimens, but such is the case. It is to be regretted, as they are much more interesting than "Texas Bill's rich bar." Soon there will be only the scientific corps to watch, and something may be done. Gen. Crook arriving at Rapid Creek, prepared his proclamation and issued it on July 29. The miners had received an intimation of what was coming and the news was passed from gulch to gulch, and their camp fires burned late into the night while they discussed the situation. In fact, many had fled like quail to cover. "Crook was coming," and "that Mix who came here last Winter." The men in the camp on "Stand-off Bar" expecting the chieftain, before night were nearly caught. Two tents and "grub" had been hid the night before, but about 8 p. m. some one sung out from the claim above: "Here they come." A general rush was made for the brush. But poor old John Allen forgot his valise. Life or death, he was bound to have the bag. Down he ran to the tent, but Capt. Mix appeared just as Allen seized the unlucky valise, and there was nothing to do but to face the demon. Behold, then, Allen's astonishment when Capt. Mix, all unconscious, mildly asked: "How does she pan?" This error was not general, and the miners boldly stood up to answer why they were there.

"It's right boys. That thar man talks squar, and I'll light out," said one man. Said another: "The fact is we ought not to fight the military for that's the United States, and that's ourselves. We are the United States."

A MINERS' MEETING.

Miners' meetings were immediately held at the various camps on Castle Creek, Rapid Creek, French Creek, and Spring Creek. The principal business accomplished was setting the time for "representation;" that is, when a man should be on the ground to assert his right to his locations. The time generally fixed upon was 60 days after the ratification of the treaty made with the Indians by Congress. There seems to be no doubt in their minds that of course the treaty will be made and the Black Hills purchased by the Government. I could be present at only one meeting, and attended the call in Janney's District at this camp. About 40 miners gathered at the Recorder's Camp. [As has been explained in a previous letter, this Recorder is a man elected in each district to record claims, &c., &c.] The crowd was not such a bearded, fierce-looking gathering of men as may be imagined. No one was shot nor was a man hung. There was plenty of time, too, before the actual business of the meeting began. Perhaps the good old times have passed away; it may be the diggings are not rich enough. Anyhow, saving the ragged and motley character of the garments worn there was nothing to surprise or amuse a stranger. Revolvers were not displayed by all persons; shirts and trousers much torn were the costume; coats were abandoned. The chairman had a coat which he carried on his arm, and when he hammered on a pine log to impress a point of order, the coat, as being parliamentary, gave a weight to his wishes not otherwise attainable. It was some time before an organization could be effect[ed]. "Every one was waiting for some one else. Many of these men had faced death in a row, an Indian fight, a snow-storm, or any other of the many conveniences of a new country. Yet to stand up now and nominate a chairman was worse than all the other perils combined. Finally the thing was done, and the election made unanimous by very loud "Yeas." Possibly this unanimity may be accounted for in their thought that if the person nominated were not elected, no one would have the courage to nominate another candidate. The business of the meeting was stated by old John Allen. He is not particularly old, but then "the boys" call him "old" anyhow. He said: "Gentlemen" [lifting his hat and scratching his head], "I guess the boys all are going out, and we want to pass resolutions which I move—gentlemen, some of the boys wrote out these moves on this paper, and I'll read 'em." The Chairman frowned, and ordered the Secretary to perform that office. Whereupon an intelligent young man jumped up and moved that "the Chairman appoint a committee to draft resolutions indicative of the sentiments of this meeting."

This was promptly carried, and report made.

RESOLUTIONS PASSED.

The following are the minutes of the meeting furnished me by Mr. Robert Forman, Secretary. The proceedings have been rewritten and altered somewhat, only, however, in the phraseology. "Old John's" speech has been more than corrected:

Pursuant to call the miners of Janney's District met at the Recorders' Camp at noon to-day. Mr. Moffat, Deputy Recorder, called the meeting to order and nominated Mr. Ad. Carlin to act as chairman of the meeting, which was seconded and carried. Mr. Robert Forman was then elected Secretary. At the request of the chairman, Mr. John Allen stated the object of the meeting. In a few brief remarks Mr. Allen said he judged the purpose of the meeting was that a common understanding might be arrived at among the miners in the gulch about the protection of existing claims; also, the fixing of a time for representation. It was moved and carried that a committee be appointed to draft resolutions. Messrs. Moffat, Allen, and Hill were appointed a Committee by the chair. The Committee subsequently presented the following resolutions:

Whereas, It has become necessary for all miners and unauthorized persons to leave the Black Hills by Aug. 15, 1875, it becomes necessary for a union of miners to protect their claims and secure to them the money and labor expended upon the same.

1. *Be it Resolved*, That a union of miners be effected for the protection of all claims against jumping or relocation until June 1, 1876.

2. That we each bind ourselves to protect and secure to each claimholder his claim, providing he complies with the above resolutions adopted at this meeting, and produces records to substantiate the fact that he was a bona fide claimholder at the time he is forced by military authority to leave his claim and the Hills.

The foregoing report was adopted, except the first resolution, which was amended to read: "That claims shall be held good up to 60 days after the ratification of the treaty by Congress." The following resolutions were then moved and carried:

Resolved, That thanks be extended to the officers and soldiers for the kindness shown to the miners of this gulch.

Resolved, That the members of this meeting sign their names to the last resolution.

Resolved, That a copy of these resolutions be preserved by the Recorder of this district.

Resolved, That a copy of the proceedings of this meeting be forwarded to the Cheyenne papers and printed.

The meeting then adjourned.

In conversation with the men attending the meeting I find it to be the intention of all on this creek to leave the region. Just as we were getting out of the bottom land and had reached the trail leading home, two men came walking wearily along from Fundle's Creek. Accosting them I found they were just in from Sioux City; they did not believe this proclamation would be enforced, and "anyhow" they were "going on to the Big Horn" country. There can be no doubt that Gen. Crook differs somewhat with them. They will not go to the Big Horn.

There will not be many miners to be met on Aug. 10 at Custer's Gulch, as recommended in the proclamation. They are leaving this region every day. Camp after camp on this creek has "pulled up stakes" and departed. Every day parties have passed along from the creeks north of this place. There is the same movement from French Creek. A curious question has arisen as to what has become of the animals that brought these people in. Those departing are nearly all walking; very few are mounted as when coming in. The teams are much dilapidated, wanting a horse here, and there an ox. A "spike" team passed to-day—two oxen at the pole and one of those patient little donkeys pulling "spike" fashion. What enduring little things the donkeys are, and what loads they carry when used as pack animals! When I remonstrated the other day with a teamster for overloading one of them, he replied: "What do yo think he's made of, Mister? Maybe salt? Or molasses? Why that 'er buorro [taken from the Mexican language] kin tote 300! Can't ye, Johnnie?" Johnnie did not give an opinion, but followed his owner in a submissive way, like a whipped wife following a drunken scamp.

MOVEMENTS OF THE SOLDIERS.

On Aug. 10, the time appointed by Gen. Crook for the miners to meet, Col. Dodge, commanding the Black Hills expedition, will go to Camp Harney in Custer's Gulch. For the present he will superintend the execution of Gen. Crook's orders. Lieut. Hall, with 1 Company 2d Cavalry, will be stationed at that point until Capt. Pollock, 9th Infantry, arrives from Fort Laramie with his command of one company of infantry and two of cavalry. These will be Capt. Pollock's company 9th Infantry, Capt. Wells's 2d Cavalry, and Captain Henry's 3d Cavalry. It is understood that Capt. Pollock will rigidly enforce the order of ejectment, but harsh means are to be avoided. There will be no need of force in making arrests of any skulking parties who may try to hide. They will be so small in numbers as to be easily managed. It is said the Captain has been selected for this important duty because of his tact and judgment. He will have need of both. The station will be a hard one for him, and the duty especially severe for the troops. Snow will begin to fall in these mountains in September, and by November the Hills will most likely be blockaded.

On Aug. 28, as stated, Gen. Crook went on to Rapid Creek. The rest of the party, who remained in camp on Spring Creek, were conducted through the diggings. The work done by the scientific party and soldiers in "prospecting" this stream was one of the first sights to be seen. The dam and ditch, the sluicing, the panning, furnished an interesting entertainment. A pan of dirt was taken and "panned" out for the visitors in order that they "might see the veritable gold taken right from that creek," as one man expressed himself. It turned out a good "prospect" about three cents, and afforded a pleasant incident to be remembered. Major Morton of the 9th Infantry, one of the guests, who is an old Californian, threw up his hands and exclaimed, "There's the color sure enough. It carries me back to the time on American River in 1852. There's nothing like it here. When we got the river turned—three month's hard work, which cost about $40,000—we had our fortunes. One piece of bed rock, the first and last cleared, was so rich that the particles of gold could be seen as often as you threw the dirt into the sluice. No more mining for me though. One night a great deal of rain fell, and melted the snow in the mountains. We woke next morning, and dam, ditch, and sluices were swept clean as a whistle. I went to San Francisco, and haven't mined since. But I'll sling one pan here just for old times." And the Major handled a pan of dirt for us in a manner showing he had not forgotten how to do it.

Some of the party complained of their ill luck at hunting; the New-York man especially. The Black Hills would not be Black Hills without getting some game. Under the management of one of the officers of the camp, Messrs. Foster and Campbell had the honor one afternoon of killing three fine large deer; the first blood for the party on the trip. It was a feather in their caps, as Gen. Crook is one of the best of hunters and Gen. Smith has had hunting experience. Subsequently the party moved over to Rapid Creek, where a grand hunt was arranged by Col. Dodge. The details will be published doubtless. It is enough to say here that their bag for the two days was 31 deer and elk and one sheep. Gen. Crook led the score, Mr. Campbell next, and Mr. O'Connor of Washington was a good third. Col. Dodge was not placed. This is to be wondered at, he being not only a good shot but a good hunter, two attributes not always, not even usually, combined. Col. Dodge is engaged writing a book to be published this Winter in London, which will contain among other things a compilation of facts and stories about the game of this Western country.

ASCENT OF HARNEY'S PEAK.

The scientific party of the expedition, under Mr. Newton, has returned from a successful ascent of Harney's Peak. Dr. McGillycuddy was the first to succeed in this dangerous attempt. A foot hill, so to speak, was climbed by some members of Custer's expedition, but the topmost spire was not reached. The doctor, by some severe climbing, succeeded in fixing a lariat, so that the rest of the party obtained the first footing or step beyond which they were able to ascend to the very summit. Capt. Tuttle furnished me with the latitude of the Peak, which I believe has not been before accurately obtained, and also the altitude. They are as follows: latitude, 43°, 50', 02"; hight, 7,400 feet.

Mr. Root, of whom I have spoken so often in previous letters as the Mining Superintendent, informs me, after a second inspection, that the reports from Castle Creek are greatly exaggerated. This is as I had supposed. However, these things are over now for this year; and the scientific men, Mr. Newton, Dr. McGillycuddy, Mr. Tuttle, and Mr. Root, will plod along in their sure way.

I had almost forgotten to state that before the coming of Gen. Crook numbers of miners were leaving the Hills disheartened. Tools and "grub" could be bought at prices below Cheyenne rates, and "claims" were to be had for the asking almost. It is asserted that these people are not miners, but "tender feet," who "came into the Hills expecting to pick up nuggets as one picks blackberries." Rather a heavy fruit, to be sure, but the figure expresses the idea intended. It is true a great many idiots come in here with wild expectations, and many have left disgusted, yet some remain. To this class do not belong the men who are working hard trying to demonstrate to themselves if there is anything in the country worth remaining to secure. Whether these men have anything or not to base hope upon, they are to be respected for their industry, and I for one hope their reward may come up to their wishes in some degree. It may be that a lucky few will strike a "bar" here and there that will repay the labor expended. In very many cases ground will be "prospected" by them, giving a fair enough display of gold for capitalists to purchase the claim. Gulches will be opened possibly in time so as to make fair returns. I believe there is enough proved already on which to base such a judgment; nothing more. As already shown by examples in previous letters the tests by "sluicing" on this creek, as on French Creek, and trials by "rocking" on Castle Creek and Rapid Creek give only fair returns. It may be asked "Why will not fair returns be as good for the poor man as the capitalist?" There are many objections. Ten per cent on $100,000 is a handsome rate of return, which on $100 would mean starvation. Capital can afford to import a large amount of labor at wages that a man working for himself could not live upon. Capital can afford to buy improved appliances, dig expensive ditches, and pay for a hundred other things, which one cannot do who is working on his own time with no immediate returns. Withal this will be a mining region. That is, for many years men will come and try to do what others have failed in, believing in themselves and their abilities. These claims will perhaps in time be bought by companies.

ORIGIN OF LIFE ON EARTH.

ADDRESS BY PROF. J. W. DAWSON OF MONTREAL.

ADDRESS OF ONE OF THE VICE-PRESIDENTS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE—AN ARGUMENT AGAINST THE DARWINIAN THEORIES—CHANGE FROM ONE SPECIES TO ANOTHER NOT PROVED OR PROVABLE—POINTS IN WHICH ALL PALEONTOLOGISTS CAN AGREE.

[FROM A STAFF CORRESPONDENT OF THE TRIBUNE.]

DETROIT, Aug. 12.—This year the American Association for the Advancement of Science has taken what the politicians call a new departure. The new constitution fits this body like an untried harness, rubbing in spots, and rendering motion in it awkward. A great deal of time is necessarily spent in accommodating the Association to the improved order of things. It was, for instance, discovered this morning that one of the persons elected yesterday to the honors of the Standing Committee—Prof. E. S. Morse—was, by virtue of the office he already held as Secretary of Section B, already practically a member of the Standing Committee. He therefore resigned the position to which he was elected yesterday. The Association at first hesitated about accepting his resignation. A great deal of explanation was necessary before the situation could be fairly apprehended. Then it became necessary to elect somebody to fill the vacancy. It was proposed to do this by acclamation, suspending the rules and taking the name that stood highest among the unsuccessful ones of yesterday's ticket. But meanwhile other names were sent up for nomination, and there was nothing left but to order a new election. This was at last accomplished, and Prof. F. W. Clarke of Cincinnati was chosen to complete the number of the Standing Committee.

One of the effects of the new constitution is that the Vice-Presidents, who are the presiding officers of the sections, will each deliver addresses. This is after the style of the British Association, and these addresses will form the most prominent features of the meeting—next, of course, to the address of the retiring President. The papers read will be, comparatively speaking, overshadowed thereby. The Vice-Presidents were selected with a view to this arrangement. Prof. J. W. Dawson, Principal of McGill College, Montreal, and Vice-President of Section B, is expected to deliver to-morrow an address of great ability, in which he will state his exact position on the doctrine of Evolution. As the great opponent of Darwinian theories, Dr. Dawson has no peer in this country since the death of Prof. Agassiz. W. C. W.

PROF. DAWSON'S ADDRESS.

Of the leaders in natural science, the guides and teachers of some of us who are now becoming gray, who have in the past year been stricken by death from the roll of workers here, and have entered into the unseen world, two rise before me with special vividness on the present occasion: Lyell, our greatest geological thinker, the classifier of the tertiary rocks, the summer-up of the evidence of the antiquity of man; but above all the founder of that school of geology which explains the past changes of our globe by those at present in progress; and Logan, the careful and acute stratigraphist, the explorer and establisher of the Laurentian system, and the first to announce the presence of fossil remains in those most ancient rocks. What these men did, and what dying they left undone, alike invite us to the consideration of the present standpoint of geological science, the results it has achieved and the objects yet to be attained; and I propose accordingly to select a small portion of this vast field and to offer to you a few thoughts in relation to it, rather desultory and suggestive, however, than in any respect final. I shall therefore ask your attention for a short time to the question, "What Do We Know of the Origin and History of Life on Our Planet?"

This great question, confessedly accompanied with merely difficulties and still waiting for its full solution, has points of intense interest both for the geologist and the biologist. In treating of it here it will be well, however meager the result, to divest it of many speculative views and to present as far as possible the actual facts in our possession and the conclusions to which they seem to point.

"If," says that greatest of uniformitarian geologists, who has so recently passed away, "the past duration of the earth be finite, then the aggregate of geological epochs, however numerous, must constitute a mere moment of the first, a mere infinitesimal portion of eternity." Yet to our limited vision, the origin of life fades away in the almost illimitable depths of past time, and we are ready to despair of ever reaching, by any process of discovery, to its past steps of progress. At what time did life begin? In what form did dead matter first assume or receive those mysterious functions of growth, reproduction and sensation? Only when we picture to ourselves an absolutely lifeless world, destitute of any germ of life or organization, can we realize the magnitude of these questions, and perceive how necessary it is to limit their scope if we would hope for any satisfactory answer.

I shall here dismiss altogether that form in which these questions present themselves to the biologist, when he experiments as to the evolution of living forms from dead liquids or solids—an unsolved problem of spontaneous generation which might alone occupy the whole time of this Section. Nor shall I enter on the vast field of discussions as to modern animals and plants opened up by Darwin and others. I shall confine myself altogether to that historical or paleontological aspect in which life presents itself when we study the fossil remains entombed in the sediments of the earth's crust, and which will enable me at least to show why some students of fossils hesitate to give in their adhesions to any of the current notions as to the origin of species. I may also explain that I shall avoid, as far as possible, the use of the term evolution, as this has recently been employed in so many senses as to have become nearly useless for any scientific purposes, and that when I speak of creation of species, the term is to be understood not in the arbitrary sense forced on it by some modern writers, but as indicating the continuous introduction of new forms of life under definite laws, but by a power not emanating from within themselves, nor from the inanimate nature surrounding them.

TWO GREAT LAWS OF LIFE.

If we were to follow the guidance of those curious analogies which present themselves when we consider the growth of the individual plant or animal from the spore or the ovum, and the development of vegetable and animal life in geological time—analogies which, however, it must be borne in mind can have no scientific value whatever, inasmuch as that similarity of conditions which can alone give force to reasoning from analogy in matters of science is wholly wanting, we should expect to find in the oldest rocks embryonic forms alone, but of course embryonic forms suited to exist and reproduce themselves independently.

I need not say to paleontologists that this is not what we actually find in the primordial rocks. I need but to remind them of the early and remarkable development of such forms as the Trilobites. I need only refer to the Lingulidæ and the Pteropods, all of them highly complex and specialized types, and remote from the embryonic stages of the groups to which they severally belong. In the case of the Trilobites, the beautiful symmetry of their parts, both transversely and longitudinally, their division into distinct and differentiated regions, the complexity of their muscular and nervous systems, their highly complex visual organs, the superficial ornamentation and microscopic structure of their crusts, their advanced position among Crustaceans indicated by their strong affinities with the Isopods. All these characters give them an aspect far from embryonic. While, as Barrande has pointed out, this advanced position of the group has its significance greatly strengthened by the fact that in early primordial times we have to deal not with one species but with a vast and highly differentiated group, embracing forms of many and varied subordinate types. As we shall see, these and other early animals may be regarded as of generalized types but not as embryonic. Here then meets us at the outset the fact that in as far as the great groups of annulose and molluscous animals are concerned, we can trace these back no further than in a period in which they appear already highly advanced, much specialized, and represented by many diverse forms. Either therefore these great groups came in on this high initial plane, or we have scarcely reached half way back in the life history of our planet.

We have here, however, by this one consideration attained at once to two great and dominant laws regulating the history of life. First, the law of continuity, whereby new forms come in successively, throughout geological time, though as we shall see with periods of greater and less frequency. Secondly, the law of specialization of types whereby generalized forms are succeeded by those more special, and this probably connected with the growing specialization of the inorganic world. It is this second law which causes the parallelism between the history of successive species and that of the embryo.

PALEONTOLOGICAL ASPECTS OF LIFE.

But there are great masses of strata known as Lower Cambrian, Huronian, Laurentian, which have made as yet few revelations as to the life which may have existed at the time of their deposition. In these rocks we know the problematical *Aspidella* of Billings from Newfoundland, the worm-burrows of Scolithus-like objects which occur in the pre-Silurian rocks of Madoc, the *Eozoon Bavaricum* of Gumbel, and the *Eozoon Canadense*, first made known by Logan, in the Laurentian of Canada. The first of these names represents a creature that may have been a mollusk, allied to Patella, or some obscure form of crustacean. The cylindrical holes called worm-burrows, are of course quite uncertain in their reference. They may represent marine worms in no respect different from those now swarming on our shores, or sponges, or corals, or sea-weeds. In any case they afford little help in explaining the teeming life of the primordial seas, and we can only hope that the vast thickness of sediments which has afforded these few traces of life may prove more fertile in the future. One slender beam of light in the darkness is, however, afforded by the *Eozoon Bavaricum* of Gumbel. If truly a fossil, this creature is closely connected with the still older *Eozoon* of the Laurentian. It therefore points backward to what is to us the dawn of life, but has no close link of connection with the succeeding fauna. On the other hand *Aspidella* and *Scolithus* may be held, if obscurely, to point forward. Thus the Huronian and early Cambrian become a period of transition from the Protozoa of the Laurentian to the higher marine life that succeeds—a passage to be more fully explained perhaps, and its great gaps filled by future discoveries; but which may, as in some later periods, be complicated with a contemporaneous transition from oceanic to shallow-water conditions in the localities open to exploration.

It will be observed that I take for granted the animal nature of *Eozoon*. If we reject this we stand face to face with the bare, bald mystery of the abrupt manifestation of the Primordial fauna, without even so much of preparation as may be supposed to arise from the previous appearance of Protozoa.

How then stands the question as to the Proto-foraminifer? In answering this question, we should, I think, endeavor to divest ourselves of certain prejudices, and to give due weight to some probabilities and analogies which may in one way or another sway our opinion.

LAURENTIAN ROCKS OF ORGANIC ORIGIN.

First, we must be prepared to find that those old crystalline rocks which we call Laurentian, have no real affinity with intrusive granites and other igneous masses, but are most nearly allied to modern sedimentary deposits. That the original chemical character of some of these ancient sediments may have differed to some extent from that of more modern sediments I do not doubt.

Yet it is true that the more common of them, as the Gneisses, Diorites, and Mica-schists, consist of precisely the same elements which now appear in modern clays and sand; and that where local alteration has affected more modern rocks, we see these passing by insensible gradations into similar metamorphic beds. Further, when the old crystalline rocks are subjected to subaerial disintegration, they resolve themselves again into the most common sedimentary materials.

Another consideration here is the unequal manner in which sediments become altered according to their composition, and to the extent to which they are permeable by heated waters and vapors. For this reason, also, contiguous beds of rock will often be seen to differ very much in the degree of their alteration. Further, some beds, and more especially limestones, continue to retain traces of organic structure long after these have perished from neighboring beds of different chemical composition. More especially when in limestone the cavities and pores of the fossils have been penetrated with other mineral matter, it would appear that nothing short of actual fusion will serve to obliterate them. Again, microscopic structures are often well preserved when the external forms have been lost, or are completely inseparable from the matrix, and in the present state of microscopic science there is little danger that in such specimens any experienced microscopist will fail to perceive the difference between organic and crystalline structures.

Having freed ourselves from misconceptions of these kinds, we may next turn to certain presumptions established by the constitution of the Laurentian rocks, and the minerals contained in them.

The limestones of the Laurentian system are of great thickness and of vast geographical extent. Sir W. E. Logan has traced and measured three principal bands of these limestones, ranging in thickness from 60 to 1,500 feet, and traceable continuously in one district of Canada for more than 100 miles, while their actual horizontal area must be enormously greater than this distance would indicate. These limestones are also associated with Gneissose and Schistose beds, exactly in the same way in which Paleozoic limestones are associated with sandstones and shales; and some of them are ordinary limestones, while others are more or less dolomitic, in which also they resemble the Paleozoic limestones. Every geologist knows that the beds which in the succeeding geological periods are the representatives of these Laurentian limestones are not only fossiliferous, but largely composed of the debris of oceanic organisms, and that it is to the purer and more crystalline beds that this statement most fully applies. May we not reasonably infer that the great Laurentian limestones are of similar origin?

One feature of these beds which has sometimes received a very different interpretation, I would here place in this connection. It is the association of Hydrous Silicates, and especially of Serpentine and Loganite, with the limestones, an association not universal but by no means uncommon in the Laurentian, and which may now be affirmed to occur throughout the whole series of marine organic limestones up to the chalky foraminiferal mud now accumulating in the depths of the ocean. It is true that the Silicates found in different formations differ somewhat in composition, but Dr. Sterry Hunt has shown that the Serpentines, Ioliite, Loganite, and the various Glauconites constitute a single series, whose members graduate into each other, and some of the modern Glauconites are not essentially distinct from the most ancient Serpentine.

This association is not accidental. It arises in the first place from the facility afforded for the combination of silica with bases, arising from the presence of organic matter in the sea-bottom, and secondly from the abundance of soluble silica in the hard parts of diatoms, radiolarians, and sponges, while these form the chief food of animals building their own skeletons of carbonate of lime, and not unfrequently having no need of silica. In this point of view the hydrous silicates may be regarded as a sort of coprolitic matter, rejected by foraminifers and other humble marine animals having calcareous skeletons. I hold, therefore, that the association of serpentine and loganite with the Laurentian limestones affords an additional reason for regarding them as organic, while it also explains the favorable conditions in which foraminiferal fossils for the permanent preservation of the structures of these beds.

But again, there are vast quantities of carbon in these limestones and the associated beds. The quantity of carbon in some large regions of the Lower Laurentian in Canada, is, as I have elsewhere shown, comparable with that in similar thicknesses of the carboniferous system. But what geologist refers the carbon of the Paleozoic rocks to any other than an organic origin? True it is that this carbon of the Laurentian is in the state of graphite and destitute of organic structure; but this applies to similar material in other altered rocks, for example, to the graphitic shales of the Silurian of Eastern Canada and to the coal of Rhode Island.

Lastly, ought we not to attach some value to that generalization of our colleague, Dr. Hunt, which affirms that the grand agent in the reduction and solution of the peroxide of iron has been organic matter. In this case what incalculable quantities of perished carbonaceous matter must be represented by the great beds of magnetite in the Laurentian.

FOSSILS IN LAURENTIAN ROCKS.

If, then, it is not unreasonable to believe that the Laurentian limestones may be of organic origin, the next question that occurs relates to the state of preservation in which the remains of such supposed organisms may occur. It would be conceivable that the process of crystalline rearrangement of particles might have proceeded so far as entirely to obliterate all traces of organic form or structure; judging from other cases of altered limestones, this would be scarcely likely. In such limestones, it is true, the fossils are often so obscure as to make little appearance on a fresh fracture of the stone, but they may present themselves distinctly on the weather surfaces, in consequence of some difference either in resisting power or hardness between the fossil and the matrix. In some cases also they can readily be developed by the action of an acid, and still more frequently their microscopic textures remain when the external forms are entirely concealed. There are few crystalline marbles, once fossiliferous, that do not exhibit indications of their true nature in one or other of these ways.

It was precisely in the ways above indicated that *Eozoon Canadense* was first brought to light. The casts of its flattened chambers filled with Serpentine, Loganite or Pyroxene, project from the weathered surfaces of the Laurentian limestones, exactly as silicified Stromatopora do in the Silurian. Such specimens, collected by the explorers of the Canadian Survey, first gave the idea that there were fossils in these ancient rocks, and the microscope soon confirmed the indications afforded by external form, and demonstrated the place of the organisms in the animal kingdom.

Into the description of the forms and structures of Eozoon it would be out of place to enter here. The details of these may be found in the publications specially devoted to its description. I would merely insist on the entire conformity of the microscopic structures as I have myself examined and described them, and as they have been further scrutinized by Dr. Carpenter and others best fitted to judge, with those of the calcareous tests of Foraminifera, and especially of the Nummuline group, and on the harmony of these structures with what the general considerations already referred to would lead us to expect.

THE EOZOON.

It is, however, appropriate to our present subject, to inquire as to the position of Eozoon in the scale of animal existence, and its possible relations to preceding or succeeding types of life. With reference to these questions it is obvious that we can predicate nothing as to the relation of our proto-foraminifers to the varied life of the Primordial or to any other group of animals than its own. We do not know that Eozoon was the only animal of its time. It may be merely a creature characteristic, like some of its successors of certain habitats in the deep sea. Foraminifera have existed throughout the whole of geological time; but we have no positive evidence that any animal of this class has ever been transmuted into any other kind of creature. These considerations oblige us to restrict our inquiries to the relation of Eozoon to other forms of Foraminiferal life. We may the more excusably take this ground since even Hæckel, in his gastrula theory, has so strenuously maintained the distinctness of the Protozoa from all higher forms of life. Viewed in this way, we find that the proto-foraminifer was the greatest of all in point of magnitude, one of the most complex in regard to structure, comprehensive in type as connecting the groups now recognized as the Nummulites and Rotalines, and the if inferior in anything only in less definiteness of habit of growth, a character in which it is paralleled by the sponges and other groups of higher rank. Thus if Eozoon was really the beginning of the Foraminifers, this, like other groups in later times, appeared at first in one of its greatest and best forms, and its geological history consists largely in a gradual deposition from its high place as other and higher types little by little took its place; for degradation as well as elevation belongs to the plan of nature. Eozoon, however, here brings under our notice another phase of a creative law, which is corroborated by the other forms of life in the succeeding periods. It is this. New types do not usually appear in their lowest forms, but in somewhat high if generalized species. The fact that Foraminifera, allied to Eozoon, have continued to exist ever since, introduces us to still another, namely, that though species and individuals die, any large group once introduced is very permanent, and may continue to be represented for the remainder of geological time.

PRIMORDIAL FAUNA.

But let us leave for the present this somewhat incommunicative Eozoon, and the few scattered forms of the Huronian and early Cambrian life, and go on further to the Primordial fauna. This is graphically presented to us in the sections at St. David's in South Wales, as described by Hicks. Here we find a nucleus of ancient rocks supposed to be Laurentian, though in mineral character more nearly akin to our Huronian, but which have hitherto afforded no trace of fossils. Resting unconformably on these is a series of partially altered rocks, regarded as Lower Cambrian, and also destitute of organic remains. These have a thickness of almost 1,000 feet, and they are succeeded by 3,000 feet more of similar rocks, still classed as Lower Cambrian, but which have afforded fossils. The lowest bed which contains indications of life is a red shale, perhaps a deep sea bed, and possibly itself of organic origin, by that strange process of decomposition or dissolution of foraminiferal ooze, described by Dr. Wyville Thomson as occurring in the South Pacific. The species are two *Lingulellæ*, a *Discina* and a *Leperditia*. Supposing these to be all, it is remarkable that we have no Protozoa or Corals or Echinoderms, and that the types of Brachiopods and Crustaceans are of comparatively modern affinities. Passing upward through another 1,000 feet of barren sandstone, we reach a zone in which no less than five genera of Trilobites are found, along with Pteropods and a sponge. Thus it is that life comes in at the base of the Cambrian in Wales, and it may be regarded as a fair specimen of the facts as they appear in the earlier fossiliferous beds succeeding the Laurentian. Taking the first of these groups of fossils, we may recognize in the *Leperditia* an ostracod Crustacean closely allied to forms still living in the seas and fresh waters. The *Lingulellæ*, whether we regard them as molluscoids, or with our colleague, Prof. Morse, as singularly specialized worms, represent a peculiar and distinct type, handed down, through all the vicissitudes of the geological ages, to the present day. Had the Primordial life begun with species altogether inscrutable and unexampled in succeeding ages, this would no doubt have been mysterious; but next to this is the mystery of the oldest forms of life being also among the newest. One great fact shines here with the clearness of noonday. Whatever the origin of these creatures, they represent families which have endured till now in the struggle for existence without either elevation or degradation. Here again we may formulate another creative law. In every great group there are some forms much more capable of long continuance than others. Lingula among the Brachiopods is a marked instance.

But when, with Hicks, we surmount the mass of barren beds overlying these remains, and which, from its unfossiliferous character, is probably a somewhat rapid deposit of arctic mud, like that which in all geological time has constituted the rough filling of our continental formations, we have suddenly sprung upon us five genera of Trilobites, including the lowest-jointed and most many-jointed, the smallest and the largest of their race, bewilderment must increase, till we recognize the fact that we are now in the presence of another great law of creation, which provides that every new type shall be rapidly extended to the extreme limits of its power of adaptation.

Before considering these laws, however, let us in imagination transfer ourselves back to the Primordial age, and suppose that we have in our hand a living Platonia, recently taken from the sea, flapping vigorously its great tail, and full of life and energy; an animal larger and heavier than the modern king crab of our shores, furnished with all that complexity of external parts for which the crustaceans are so remarkable, no doubt with instincts and feelings and modes of action as pronounced as those of its modern allies, and if Woodward's views are correct, on a higher plane of rank than the king crab itself, inasmuch as it is a composite type connecting Limulo with Isopods. We have obviously here in the appearance of this great crustacean a repetition of the facts which we met with in Eozoon; but how vast the interval between them in geological time and in zoological rank. Standing in the presence of this testimony I think it is only right to say that we possess no causal solution of the appearance of these early forms of life; but in tracing them and their successors upward through the succeeding ages we may hope at least to reach some expressions of the laws of their succession, in possession of which we may return to attack the mystery of their origin.

First, it must strike every observer that there is a great sameness of plan throughout the whole history of marine invertebrate life. If we turn over the pages of an illustrated text-book of geology, or examine the cases or drawers of a collection of fossils, we shall find extending through every succeeding formation representative forms of crustaceans, mollusks, corals, etc., in such a manner as to indicate that in each successive period there has been a reproduction of the same type with modifications; and if the series is not continuous, this appears to be due rather to abrupt physical changes; since sometimes where two formations pass into each other we find a gradual change in the fossils by the dropping out and introduction of species one by one. Thus in the whole of the great Paleozoic Period, both in its Fauna and Flora, we have a continuity and similarity of a most marked character.

It is evident that there is presented to us in this similarity of the forms of successive faunas and floras, a phenomenon which deserves very careful sifting as to the question of identity or diversity of species. The data for this comparison must be obtained by careful study of the series of closely allied forms occurring in successive formations, and our great and unexhausted Paleozoic areas in America, as Nicholson has pointed out, seem to give special facilities for this, which should be worked, not in the direction of constituting new species for every slightly divergent form, but in striving to group these forms into large specific types. The Rhynchonellæ of the type of *R. pleua*, the Orthids of the type *O. testudinaria*, the Strophomenæ of the types of *S. alternata*, and *S. rhomboidalis*, the Atrypæ of the type of *A. reticularis*, furnish cases in point among the Brachiopods. There is nothing to preclude the supposition that some of these groups are really specific types, with numerous race modifications. My own provisional conclusion, based on study of Paleozoic plants, is that the general law will be found to be the existence of distinct specific types, independent of each other, but liable in geological time to a great many modifications, which have often been regarded as distinct species.

UNITY OF SUCCESSIVE FAUNÆ.

While this unity of successive faunæ at first sight presents an appearance of hereditary succession, it loses much of this character when we consider the number of new types introduced without apparent predecessors, the necessity that there should be similarity of type in successive faunæ on any hypothesis of a continuous plan and above all, the fact that the recurrence of representative species or races in large proportion marks times of decadence rather than of expansion in the types to which they belong. To turn to another period, this is very manifest in that singular resemblance which obtains between the modern mammals of South America and Australia, and their immediate fossil predecessors—the phenomenon being here manifestly that of decadence of large and abundant species into a few depauperated representatives. This will be found to be a very general law, elevation being accompanied by the abrupt appearance of new types and decadence by the apparent continuation of old species, or modifications of them.

This resemblance with difference in successive faunas also connects itself very directly with the successive elevations and depressions of our continental plateaus in geological time. Every great paleozoic limestone, for example, indicates a depression with intervening elevation. On each elevation marine animals were driven back into the ocean, and on each depression swarmed in over the land, reënforced by new species, either then introduced or derived by migration from other localities. In like manner in every depression land-plants and animals were driven in upon insular areas, and on reëlevation again spread themselves widely. Now, I think it will be found to be a law here that periods of expansion were eminently those of introduction of new specific types, and periods of contraction those of extinction, and also of continuance of old types under new varietal forms.

It must also be borne in mind that all the leading types of invertebrate life were early introduced; that change within these was necessarily limited, and that elevation would take place mainly by the introduction of the vertebrate orders. So in plants; Cryptogams early attained their maximum as well as Gymnosperms, and elevation occurred in the introduction of Phænogams, and this not piecemeal, but as we shall see in the sequel, in great force at once.

Another allied fact is the simultaneous appearance of like types of life in one and the same geological period, over widely separated regions of the earth's surface. This strikes us especially in the comparatively simple and homogeneous life dynasties of the Paleozoic, when, for example, we find the same types of Silurian, Graptolites, Trilobites and Brachiopods appearing simultaneously in Australia, America and Europe. Perhaps in no department is it more impressive than in the introduction in the Devonian and Carboniferous Ages of that grand cryptogamous and gymnospermous flora which ranges from Brazil to Spitzbergen, and from Australia to Scotland, accompanied in all by the same groups of marine invertebrates. Such facts may depend either on that long life of specific types which gives them ample time to spread to all possible habitats, before their extinction, or on some general law whereby the conditions suitable to similar types of life emerge at one time in all parts of the world. Both causes may be influential, as the one does not exclude the other, and there is reason to believe that both are natural facts. Should it be ultimately proved that species allied and representative but distinct in origin come into being simultaneously everywhere, we shall arrive at one of the laws of creation, and one probably connected with the gradual change of the physical conditions of the world.

Another general truth, obvious from the facts which have been already collected, is the periodicity of introduction of species. They come in by bursts or floodtides at particular points of time, while these great life-waves are followed and preceded by times of ebb in which little that is new is being produced. We labor in our investigation of this matter under the disadvantage that the modern period is evidently one of the times of pause in the creative work. Had our time been that of the early Tertiary or early Mesozoic, our views as to the question of origin of species might have been very different. It is a striking fact, and in illustration of this, that since the glacial age no new species of mammal can be proved to have originated on our continent, while a great number of large and conspicuous forms have disappeared. It is possible that the proximate or secondary causes of the ebb and flow of life production may be in part at least physical, but other and more important efficient causes may be behind these. In any case these undulations in the history of life are in harmony with much that we see in other departments of nature.

It results from the above and the immediately preceding statement, that specific and generic types enter on the stage in great force and gradually taper off toward extinction. They should so appear in the geological diagrams made to illustrate the succession of life. This applies even to those forms of life which come in with fewest species and under the most humble guise. What a remarkable swarming, for example, there must have been of marsupial mammals in the early mesozoic, and in the coal formation the only known Pulmonates, four in number, belong to as many generic types.

TRANSMISSION OF VARIETAL FORMS.

I have already referred to the permanence of species in geological time. I may now place this in connection with the law of rapid organization and more or less continuous transmission of varietal forms. I may, perhaps, best bring this before you in connection with a group of species with which I am very familiar—that which came into our seas at the beginning of the glacial age and still exists. With regard to their permanence it can be affirmed that the shells now elevated in Wales to 1,200, and in Canada to 600 feet above the sea, and which lived before the last great revolution of our continents, a period vastly remote as compared with human history, differ in no tittle from their modern successors after thousands or tens of thousands of generations. It can also be affirmed that the more variable species appear under precisely the same varietal forms then as now, though these varieties have changed much in their local distribution. The real import of these statements, which might also be made with regard to other groups, well known to paleontologists, is of so great significance that it can be realized only after we have thought of the vast time and numerous changes through which these humble creatures have survived. I may call in evidence here a familiar New-England animal, the common sand clam, *Mya arenaria*, and its relative, *Mya truncata*, which now inhabit together all the northern seas, for the Pacific specimens, from Japan and California, though differently named, are undoubtedly the same. *Mya truncata* appears in Europe in the coralline crag, and was followed by *M. arenaria* in the red crag. Both shells occur in the Pleistocene of America, and then several varietal forms had already developed themselves in the crag, and remain the same to-day; so that these humble mollusks, littoral in their habits, and subjected to a great variety of conditions, have continued perhaps for one or two thousand centuries to construct their shells precisely as at present. Nor are there any indications of a transition between the two species. I might make similar statements with regard to the Astartes, Buccinums, and Tellinas of the drift, and could illustrate them by extensive series of specimens from my own collections.

Another curious illustration is that presented by the tertiary and modern faunæ of some oceanic islands far separated from the continents. In Madeira and Porto Santo, for example, according to Lyell, we have 56 species of land shells in the former and 42 in the latter, only 12 being common to the two, though these islands are only 30 miles apart. Now, in the Pliocene strata of Madeira and Porto Santo we find 36 species in the former and 35 in the latter, of which only eight per cent are extinct, and yet only eight are common to the two islands. Further there seem to be no transitional forms connecting the species, and of some of them the same varieties existed in the Pliocene as now. The main difference in time is the extinction of some species and the introduction of others without known connecting links, and the fact that some species, plentiful in the Pliocene, are rare now and *vice versa*. All these shells differ from those of modern Europe, but some of them are allied to Miocene species of that continent. Here we have a case of continued existence of the same forms, and in circumstances which the more we think of them the more do they defy all our existing theories as to specific origins.

Perhaps some of the most remarkable facts in connection with the permanence of varietal form of species are those furnished by that magnificent flora which burst in all its majesty on the American continent in the Cretaceous period, and still survives among us even in some of its specific types. I say survives, for we have but a remnant of its forms living, and comparatively little that is new has probably been added since. The confusion which obtains as to the age of this flora, and the discussions in which Heer, Lesquereux, Newberry, and recently Mr. G. M. Dawson, have taken part, obviously arise, as the latter has, I think, conclusively shown, from the fact that this modern flora was in its earlier times cotemporary with Cretaceous animals, and survived the gradual change from the animal life of the Cretaceous down to that of the Eocene, and even of the Miocene. In a collection of these plants from what may be termed beds of transition from the Cretaceous to the Tertiary, I find among other modern species two recent forms most curiously associated. One is the common *Onoclea sensibilis*, found now very widely over North America, and which in so-called Miocene times lived in Europe also. The other is *Davallia tenuifolia* of Eastern Asia—a fern not now even generically represented in North America, but still abundant on the other side of the Pacific. These little ferns are thus probably older than the Rocky Mountains and the Himalayas, and reach back to a time when the Mesozoic Dinosaurs were becoming extinct and the earliest Placental mammals being introduced. Shall we say that these ferns and along with them our two species of American Hazel and many other familiar plants have propagated themselves, unchanged for half a million of years?

Take from the western Mesozoic a contrasting yet illustrative fact. In the Jurassic or Cretaceous rocks of Queen Charlotte's Island, Mr. Richardson of the Canadian Survey finds Ammonites and allied cephalopods similar in many respects to those discovered further south by your California Survey, and Mr. Whiteaves finds that some of them are apparently not distinct from species described by Paleontologists of the Geological Survey of British India. On both sides of the Pacific these shells lie entombed in solid rock, and the Pacific rolls between as of yore. Yet these species, genera, and even families, are all extinct—why, no man can tell, while land plants that must have some in whole the survivors of these cephalopods still lived, come down to the present. How mysterious is all this, and how strongly does it show the independence in some sense of merely physical agencies on the part of the manifestations of life.

Such facts as these to which I have referred, and many others which want of time prevents me from noticing, are in one respect eminently unsatisfactory, for they show us how difficult must be any attempts to explain the origin and succession of life. For this reason they are quietly put aside or explained away in most of the current hypotheses on the subject. But we must as men of science face these difficulties, and be content to search for facts and laws even if they should prove fatal to preconceived views.

A group of new laws, however, here breaks upon us. (1) The great vitality and rapid extension and variation of new specific types. (2) The law of spontaneous decay and mortality of species in time. (3) The law of periodicity and of simultaneous appearance of many allied forms. (4) The abrupt entrance and slow decay of groups of species. (5) The extremely long duration of some species in time. (6) The grand march of new forms landward and upward in rank. Such general truths deeply impress us at least with the conviction that we are tracing, not a fortuitous succession, but the action of power working by law.

I have thus far said nothing of the bearing of the prevalent ideas of descent with modification on this wonderful procession of life. None of these of course can be expected to take us back to the origin of living beings; but they also fail to explain why so vast numbers of highly organized species struggle into existence simultaneously in one age and disappear in another, why no continuous chain of succession in time can be found gradually blending species into each other, and why in the natural succession of things degradation under the influence of external conditions and final extinction seem to be laws of organic existence. It is useless here to appeal to the imperfection of the record or to the movements or migrations of species. The record is now in many important parts too complete, and the simultaneousness of the entrance of the faunas and floras too certainly established, and moving species from place to place only evades the difficulty. The truth is that such hypotheses are at present premature, and that we require to have larger collections of facts.

DEFECTS OF EVOLUTION THEORIES.

Independently of this, however, it appears to me that from a philosophical point of view it is extremely probable that all theories of evolution as at present applied to life are fundamentally defective in being too partial in their character, and perhaps I cannot better group the remainder of the facts to which I wish to refer than by using them to illustrate this feature of most of our larger attempts at generalization on this subject.

First, then, these hypotheses are too partial, in their tendency to refer numerous and complex phenomena to one cause, or to a few causes only, when all trustworthy analogy would indicate that they must result from many concurrent forces and determinations of force. We have all no doubt read those ingenious, not to say amusing, speculations in which some entomologists and botanists have indulged with reference to the mutual relations of flowers and haustellate insects. Geologically the facts oblige us to begin with cryptogamous plants and mandibulate insects, and out of the desire of insects for non-existent honey and the adaptations of plants to the requirements of non-existent suctorial apparatus we have to evolve the marvelous complexity of floral form and coloring and the exquisitely delicate apparatus of the mouths of haustellate insects. Now when it is borne in mind that this theory implies a mental confusion on our part precisely similar to that which in the department of mechanics actuates the seekers for perpetual motion; that we have not the smallest tittle of evidence that the changes required have actually occurred in any one case, and that the thousands of other structures and relations of the plants and the insect have to be worked out by a series of concurrent evolutions so